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AN 16-30URM35-1

HANDBOOK

OPERATING INSTRUCTIONS

SIGNAL GENERATOR AN/URM-35

(POLARAD)

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AND THE CHIEF OF THE BUREAU OF AERONAUTICS

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TABLE OF CONTENTS

Section *Page*

I. GENERAL DESCRIPTION

1–1. Scope of the Handbook 1
1–3. Purpose of the Equipment 1
1–5. Description of the Equipment 1
1–11. Electron Tube, Fuse, and Indicator Lamp Complement. 2
1–13. Uses of the Equipment 2
1–15. Capabilities and Limitations 3
1–17. Brief Theory of Operation 3

II. OPERATING PROCEDURES

2–1. General 5
2–3. Description of Operating Controls 5
2–11. Setting Up the Equipment 5
2–13. Calibrating the Signal Generator 6
2–18. Operation for Radiated Output 6
2–20. Operation for Direct R-f Coupling 6
2–21. Operation for Video Output 6
2–22. Continuous C-w Power Monitoring. 6
2–24. Uncalibrated Operation of Signal Generator. 8
2–26. Turning the Set OFF in an Emergency. 8

III. OPERATING CHECKS AND ADJUSTMENTS

3–1. Operating Checks 8
3–4. Adjustments 8

IV. EMERGENCY OPERATION

4–1. General 8

LIST OF ILLUSTRATIONS

Figure No. *Page*

1–1. Signal Generator AN/URM-35, Components IV
2–1. Signal Generator Front Panel Controls 4
2–2. Calibration Markings on FREQUENCY IN KILOMEGACYCLES Dial 5
2–3. Operating Procedure for Calibrated Output..... 7

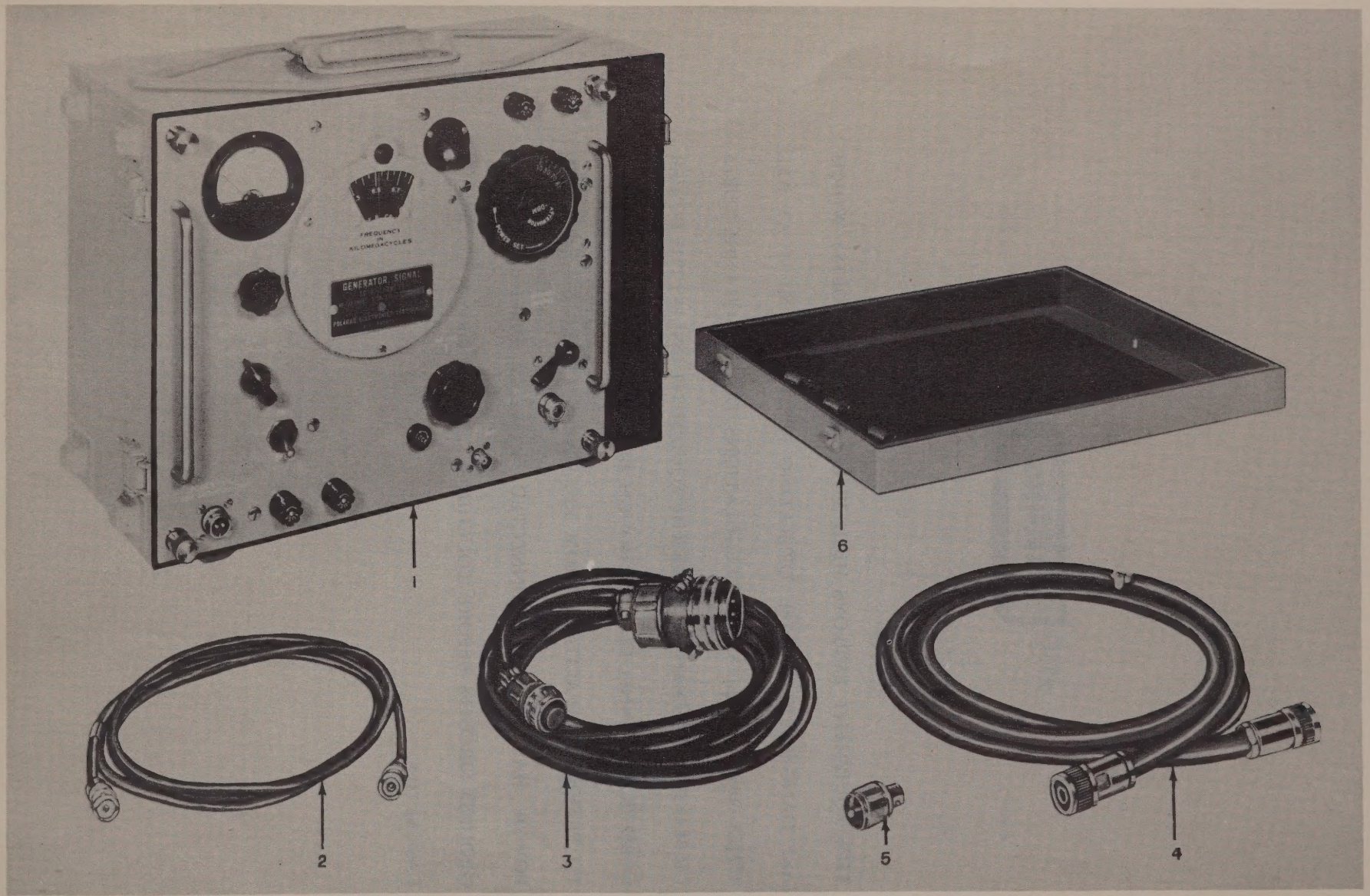
LIST OF TABLES

Table *Page*

I. Equipment Supplied 1
II. Tube Complement 2
III. Capabilities and Limitations 2

WARNING

THIS EQUIPMENT EMPLOYS HIGH VOLTAGES (2,000 VOLTS) WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT UNLESS THE POWER CORD IS DISCONNECTED. ALTHOUGH BLEEDER CIRCUITS ARE USED TO PREVENT CAPACITORS FROM RETAINING CHARGES AFTER THE POWER HAS BEEN DISCONNECTED, ALWAYS DISCHARGE AND GROUND CIRCUITS BEFORE TOUCHING THEM IN ORDER TO AVOID CASUALTIES.



Index No.	*Description*	*Index No.*	*Description*	*Index No.*	*Description*
1	Signal Generator SG–56/URM–35	3	Power Cord CX–2470/U (10′0″)	5	Adapter UG–273/U
2	Cord CG–409C/U (6′0″)	4	Cord CG–92B/U (6′0″)	6	Cover

Figure 1–1. Signal Generator AN/URM-35 Components

SECTION I

GENERAL DESCRIPTION

1–1. SCOPE OF THE HANDBOOK.

1–2. This publication contains complete instructions to enable operating personnel to utilize Signal Generator AN/URM-35 in preflight checks of broadband radar search and direction-finding equipment.

1–3. PURPOSE OF THE EQUIPMENT.

1–4. Signal Gneerator AN/URM-35 provides continuous-wave (c-w), and pulse-modulated r-f signals in the frequency range 4,450 to 8,000 megacycles per second (mc), at a power level, continuously variable, from 0 to 100 decibels below one milliwatt (–dbm). The output frequency and power level are indicated on separate direct reading dials on the front panel. The equipment also furnishes a video signal having characteristics similar to the r-f pulse which is used to check various types of pulse equipment.

1–5. DESCRIPTION OF THE EQUIPMENT.

(*See figure 1–1.*)

1–6. Signal Generator AN/URM-35 consists of the following components: Signal Generator SG-56/URM-35 mounted in a combination dust-cover and carrying case, Cord CG-92B/U (6′0″), Cord CG-409C/U (6′0″), Power Cord CX-2470/U (10′0″), and Adapter UG-273/U. These components form an operating equipment and are listed in Table I. No auxiliary equipment is required.

1–7. The signal generator is a completely self-contained compact unit. All operating controls, indicators, fuses, and receptacles are mounted on the front panel. Two handles on the front panel permit easy removal of the unit from the case and serve also to protect the front panel controls from damage. A handle on the top of the case is provided to facilitate lifting and carrying the unit in the case. To protect the unit when it is operated upright or on its side, a set of four feet is provided on the bottom and left surfaces of the case. These mounting feet, in addition make it possible to polarize the antenna in both the vertical and horizontal plane. A window, in the back of the carrying case, covered with a protective teflon dielectric sheet, provides an aperture for the cavity-type antenna which is a part of the signal generator chassis. External cables are stored in a handy compartment in the side of the case. A cover which is attached to the case by means of pulldown latches, provides a convenient storage space for handbooks and four spline wrenches. The handbooks are held under a chart holder which is riveted inside the case cover. A schematic of the equipment is provided on the inside of the chart holder.

1–8. The signal generator contains a direct reading frequency dial which is controlled over its entire range by a single knob. Continuous-wave, or pulsed c-w output can be fed to either DIRECT RF OUTPUT Receptacle J2 or to the built-in antenna for direct radiation into space.

1–9. A direct-reading calibrated attenuator controlled by the ATTENUATOR knob on the front panel makes it possible to obtain calibrated readings from 0 dbm to –100 dbm. The power reference level of one milliwatt is established by the POWER SET knob on the front panel as indicated by the power monitoring meter.

1–10. By means of Output Switch S3 (ANTENNA OUTPUT-DIRECT RF OUTPUT) the r-f signal may be fed either to Output Receptacle J2 (DIRECT RF OUTPUT) on the front panel, or to the antenna. The video signal is obtained at front panel Receptacle J4 (VIDEO PULSE OUT) when Function Switch S2 is in the PULSE postion.

TABLE I. EQUIPMENT SUPPLIED

Quantity per Equipment	*Reference Symbol No.*	*Name of Component*	*Government Type Designation*
1		Signal Generator	SG-56/URM-35
1	W102	Cord	CG-92B/U (6′0″)
1	W103	Cord	CG-409C/U (6′0″)
1	W101	Power Cord	CX-2470/U (10′0″)
1		Adapter	UG-273/U

TABLE II. TUBE COMPLEMENT

Ref. Symbol	*JAN Type*	*Quantity*	*Function*
V1, V8, V13	6X4W	3	V1, V13: Full-wave rectifier V8: Protective diode
V2	6005/6AQ5W	1	Series regulator
V3	6AU6	1	Voltage control
V4, V14	OB2	2	Voltage regulator
V5, V6, V10, V11, V18	12AT7	5	V5A: Pulse generator V5B: Pulse shaper V6: Keyer V10: Series regulator V11, V18: Voltage control
V7	5721	1	Reflex oscillator, requiring external cavity
V9, V15, V16	5R4WGY	3	Full-wave rectifier
V12, V19, V20, V21, V22	5651	5	Voltage reference
V17	6098/CT	1	Series regulator
CR1	1N69	1	Crystal diode

1–11. ELECTRON TUBE, FUSE, AND INDICATOR LAMP COMPLEMENT.

1–12. The tube complement and function of each tube are listed in Table II. Four 3 Ampere fuses, type F02G3R004 (F1 through F4) are supplied; two are spares. The indicator lamp I1 is a type AN3140-328.

1–13. USES OF THE EQUIPMENT.

1–14. The signal generator has a variety of uses in the pre-flight testing of radar sets. It can be used to check radar receiver sensitivity, antenna directivity, standing wave ratio (SWR) of transmission lines, and the video circuits of radar indicators.

TABLE III. CAPABILITIES AND LIMITATIONS

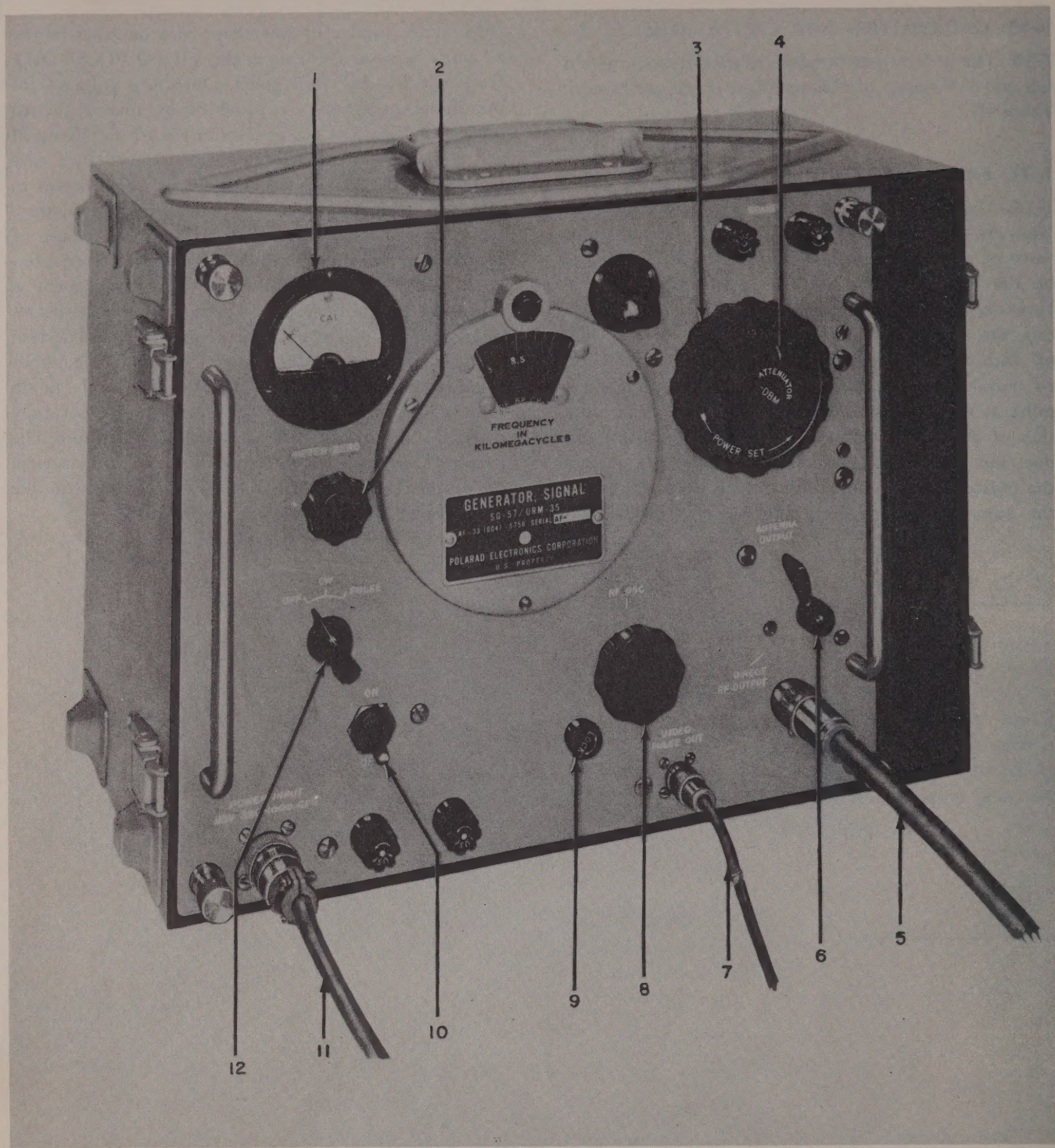
Characteristic	*Capability or Limitation*
Frequency range	4,450—8,000 mc
Frequency stability	C-w—.025% incidental frequency modulation or less Pulse—0.2% frequency shift or less, at operating frequency
Modulation	Repetition rate—1,000 ± 100 pulses per second Pulse width—3 ± .5 μs at 50% peak amplitude points Pulse rise and decay time—0.35 μs measured between 10 to 90% amplitude points
Video pulse amplitude	1.25 ± 0.5 volts terminated into a 50 ohm resistive load
Output impedance	VIDEO PULSE OUT—50 ohms resistive DIRECT RF OUTPUT—50 ohms
Power output	Continuously variable from 0 to −100 dbm ± 3 db
Antenna beam width	15° at half-power points
Power requirements	Max 270 watts at 115 volts ± 10%, 380 to 1,000 cps

1–15. CAPABILITIES AND LIMITATIONS.

1–16. The general performance characteristics, capabilities and limitations of the signal generator are given in Table III.

1–17. BRIEF THEORY OF OPERATION.

1–18. The signal generator is basically a klystron oscillator. As such, it is capable of transmitting a continuous-wave r-f signal over the range of frequencies indicated on the FREQUENCY IN KILOMEGACYCLES dial. However, it can also furnish a pulsed r-f signal. To do this, the oscillations of the klystron are keyed on and off with a pulse generated within the equipment. The r-f output from the klystron becomes a flat-topped r-f pulse at the c-w power level which lasts for the duration of the keying pulse. Between pulses the klystron does not oscillate. The frequency of both the c-w and the pulsed output is tuned by the RF OSC control. At the same time that the keying pulse is produced, a video pulse similar in waveshape and duration to the r-f pulse is made available at the VIDEO PULSE OUT receptacle on the front panel. Operating voltages for the signal generator are provided by four regulated power supplies. The power level of the r-f output signal can be varied by means of an attenuating device, controlled by the ATTENUATOR knob, which serves to remove varying amounts of r-f power from the klystron. In order to make it possible to measure the amount of attenuation, provision is made for setting a power reference level for the output signal. This adjustment is controlled by the POWER SET knob. When the power reference level of one-milliwatt is shown by a deflection on the meter to the CAL position, the level of the output signal can be read on the –DBM dial directly in db relative to one-milliwatt. This level can be set only when the klystron oscillator is in c-w operation. The r-f signal is made available either to the built-in antenna or to the DIRECT RF OUTPUT receptacle on the front panel, by means of Output Switch S3.



Index No.	*Description*	*Index No.*	*Description*	*Index No.*	*Description*
1	Meter, M1	5	Cord, W102	9	LOCK
2	METER ZERO, R64	6	Output Switch, S3	10	Power Switch, S1
3	POWER SET	7	Cord, W103	11	Power Cord, W101
4	ATTENUATOR (–DBM)	8	RF OSC.	12	Function Switch, S2

Figure 2–1. Signal Generator Front Panel Controls

SECTION II

OPERATING PROCEDURES

2–1. GENERAL.

2–2. This section contains detailed operating instructions for obtaining the various types of output available from the signal generator, a description of all operating controls, and three illustrations. Figure 2–1 is a labelled pictorial view of the generator showing the location of the controls. Figure 2–2 illustrates the calibration markings on the frequency dial. Figure 2–3 is a step-by-step illustration of the operating procedure for calibrated output.

2–3. DESCRIPTION OF OPERATING CONTROLS.

(*See figure 2–1.*)

2–4. METER ZERO. Potentiometer R64 designated METER ZERO is used to adjust the bridge circuit current to permit balancing the meter bridge circuit. A balanced bridge is indicated when the meter needle points to ZERO.

2–5. POWER SET. This control is used to set the one-milliwatt reference level by adjusting the position of the thermistor probe in the waveguide-beyond-cutoff projecting from the klystron cavity. Deflection of the meter needle to the CAL mark indicates that the reference level has been established.

2–6. ATTENUATOR. This control adjusts the position of the attenuator probe to supply the desired signal level to DIRECT RF OUTPUT Receptacle J2 or to the antenna. The –DBM dial indicates the attenuation in db below one milliwatt.

2–7. RF OSC. The frequency control designated RF OSC simultaneously drives the klystron cavity tuning mechanism and repeller voltage tracking potentiometer to tune the klystron to the desired frequency. The output frequency is indicated on the calibrated FREQUENCY IN KILOMEGACYCLES dial. Refer to figure 2–2 for calibration markings on the dial. The LOCK knob in its maximum clockwise position locks the shaft rotation of the RF OSC control.

2–8. Power Switch S1 designated ON-OFF is a double-pole single throw switch which applies and removes a-c power to the equipment.

2–9. Function Switch S2 designated OFF-CW-PULSE is a three-position rotary wafer switch which selects the desired signal output. In the CW position of the switch, a c-w signal is made available. In the PULSE position, a pulse modulated signal is selected. In the OFF position, the klystron is non-conducting, no r-f signal is produced, and the meter can be ZERO set.

2–10. Output Switch S3 designated ANTENNA OUTPUT-DIRECT RF OUTPUT permits the signal to be fed either to the built-in antenna (ANTENNA OUTPUT) or to Output Jack J2 (DIRECT RF OUTPUT).

2–11. SETTING UP THE EQUIPMENT.

2–12. No special installation procedures are necessary to set up the equipment. To prepare the generator for operation, open the four drawpull spring latches and separate the cover from the case. Connect Plug P101 of Power Cord CX-2470/U (W101), to POWER Receptacle J1 on the front panel. Connect Plug P103, the other end of the Power Cord to a 115-volt, 380 to 1000 cycle power source.

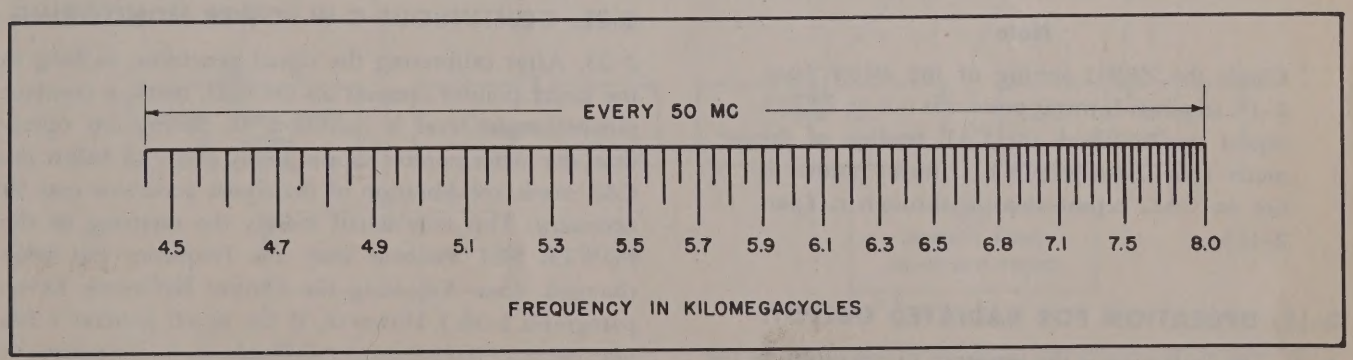


Figure 2–2. Calibration Markings on Frequency in Kilomegacycles Dial

2–13. CALIBRATING THE SIGNAL GENERATOR.

(*See figure 2–3.*)

2–14. Before using the signal generator in many of its applications, it is necessary to zero set the power bridge meter, adjust the power reference level, and set the desired power output. For this procedure refer to figure 2–3 and the following paragraphs.

2–15. ZERO SETTING THE POWER BRIDGE METER.

a. Throw Power Switch S1 to ON (1). Allow the set to warm up for at least 15 minutes.

CAUTION

Do not operate the signal generator if the blower is inoperative.

b. Turn Function Switch S2 to the OFF position (2).

c. Adjust METER ZERO control until the pointer on the meter reads ZERO (3).

2–16. ADJUSTING OUTPUT REFERENCE LEVEL.

a. Turn RF OSC knob until the desired signal frequency appears under the hairline on the FREQUENCY IN KILOMEGACYCLES dial (4).

b. Turn Function Switch S2 to the CW position (5).

c. Adjust POWER SET knob until the pointer on the meter is at the CAL mark (6). The signal generator is now at the one-milliwatt power reference level for the frequency set in step a. above.

2–17. SETTING DESIRED POWER OUTPUT.

a. Turn ATTENUATOR knob to the desired output level (7). The reading on the dial indicates power output in db below one milliwatt. If previous steps have not been followed the ATTENUATOR reading will be inaccurate.

Note

Check the ZERO setting of the meter (par. 2–15, step b.). If meter pointer is not on ZERO, repeat step c. Check the CAL reading of the meter (par. 2–16, step b.). If meter pointer is not on CAL, repeat steps a. through c. (par. 2–16).

2–18. OPERATION FOR RADIATED OUTPUT.

2–19. The following is the sequence of operation in the pre-flight checking of an airborne radar system using the signal generator radiated output:

a. Set up the equipment. (See paragraph 2–11.)

b. Calibrate the signal generator. (See paragraphs 2–13 through 2–17.)

c. Allow Function Switch S2 to remain in CW or turn to PULSE position to correspond with the radar system under test (8).

d. Set Output Switch S3 to the ANTENNA OUTPUT position (9). Place the signal generator vertically or horizontally depending on the plane of polarization desired. The antenna is horizontally polarized when the signal generator is upright and vertically polarized when it is on its side. Face the rear of the signal generator to the equipment under test. Make sure that the window is in line with the antenna of the equipment being checked. A signal should appear on the radar indicator screen.

2–20. OPERATION FOR DIRECT R-F COUPLING.

a. Perform steps a., b., and c. outlined in paragraph 2–19.

b. Connect one end of Cord CG-92B/U (W102), to the DIRECT RF OUTPUT Receptacle J2 (10) and the other end to the load (radar system under test).

c. Set Output Switch S3 to DIRECT RF OUTPUT (11). A signal should appear on the radar indicator screen.

2–21. OPERATION FOR VIDEO OUTPUT.

a. Set up the equipment as outlined in paragraph 2–11.

b. Set Function Switch S2 in PULSE position.

c. Connect one end of Cord CG-409C/U (W103), to VIDEO PULSE OUT Receptacle J4 and the other end to the radar indicator under test. If the receptacle on the indicator is a UHF type, use Adapter UG-273/U, supplied with equipment, to couple the BNC plug to the UHF receptacle.

2–22. CONTINUOUS C-W POWER MONITORING.

2–23. After calibrating the signal generator, as long as the meter pointer remains on the CAL mark, a constant power output level is indicated. If, during c-w operation, the meter pointer should swing above or below the CAL mark, recalibration of the signal generator may be necessary. This may entail merely the resetting of the POWER SET knob if only the frequency has been changed. (See Adjusting the Output Reference Level, paragraph 2–16.) However, if the signal generator has not become temperature-stabilized, it is necessary to recalibrate the generator. (See paragraphs 2–13 through 2–17.)

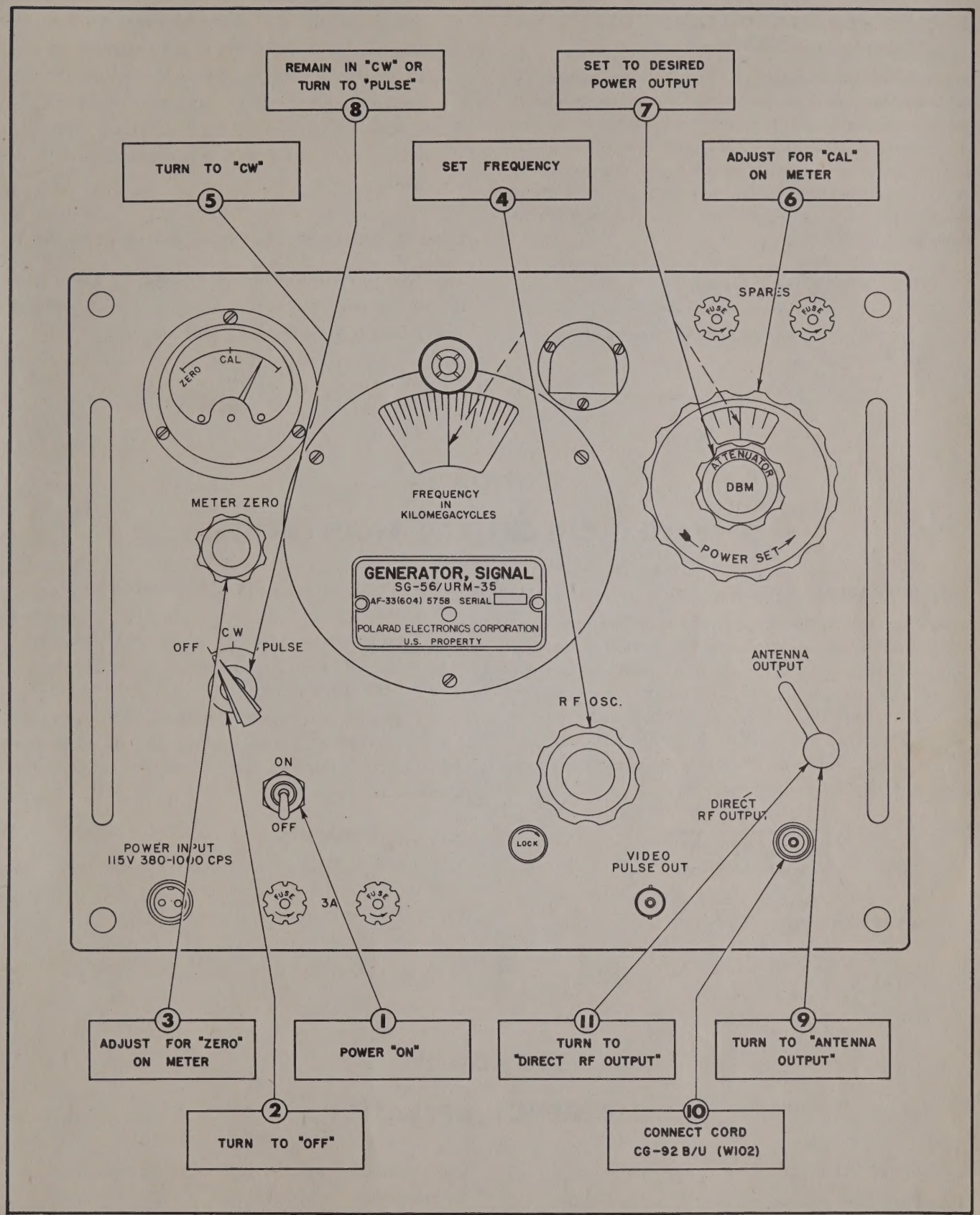


Figure 2–3. Operating Procedure for Calibrated Output

2–24. UNCALIBRATED OPERATION OF SIGNAL GENERATOR.

2–25. When radar system checks other than sensitivity measurements are to be performed, the signal generator need not be calibrated. It is only necessary to set up the equipment (see paragraph 2–11); set Power Switch S1 to ON (par. 2–15, step a.); turn RF OSC control to the desired frequency (par. 2–16, step a.); and set a mean power output by turning the ATTENUATOR knob to midscale (par. 2–17, step 7).

CAUTION

To prevent high power-output from causing excessive needle deflection which may damage the meter, turn the POWER SET control to its maximum clockwise position before setting the desired frequency. If an indication of power is desired, turn the POWER SET control counterclockwise until a reading is obtained on the meter.

2–26. TURNING THE SET OFF IN AN EMERGENCY.

2–27. No special procedure is required for turning off the signal generator in an emergency. Merely throw Power Switch S1 to the OFF position.

SECTION III

OPERATING CHECKS AND ADJUSTMENTS

3–1. OPERATING CHECKS.

3–2. There are no operating checks to be performed on the signal generator. However, to ascertain that the equipment is in good operating order perform the steps outlined in paragraph 2–11, and set the Power Switch S1 to ON. The blower motor should start and the pilot lamp should light the FREQUENCY IN KILOMEGACYCLES dial. Perform the following calibration check after sufficient warm-up period.

CAUTION

Do not operate the signal generator if the blower is inoperative.

3–3. SIGNAL GENERATOR CALIBRATION CHECK.

a. Turn Function Switch S2 to the OFF position.

b. Rotate METER ZERO control. It should be possible to ZERO the meter.

c. Turn Function Switch S2 to the CW position.

d. Rotate POWER SET control. If it is possible to adjust meter to the CAL mark, the equipment is capable of calibrated operation.

3–4. ADJUSTMENTS.

3–5. The signal generator is adjusted at the factory before shipment and requires no further adjustments in the field other than those discussed in Section II under Operating Procedures.

SECTION IV

EMERGENCY OPERATION

4–1. GENERAL.

4–2. The signal generator is a calibrated manually-operated instrument; consequently, no method of operation other than the normal is possible. If the equipment fails to function as described in this handbook refer to the applicable "Handbook Service Instructions."